of the rainfall at 27 stations from January 1 to August 31, 1870-79, and for the same period in 1887, and expressing the difference of 1887 from the average as a percentage, it appears that the mean percentage this year has been: for England 59·8, for Wales 60·0, for Scotland 68·5, and for Ireland 60·3. Out of 11 stations in England the drought is unprecedented at 6, in Scotland at 6 stations out of 8, and in Ireland at 5 stations out of 6. Scotland has suffered least, and in parts of England the deficiency has reached the extreme limit that may be expected. There appears to be no good definition of a drought. In 1880 Mr. Symons adopted a classification for his numerous observers, which has generally been used up to the present time, viz. (1) absolute drought, being a period of 14 or more consecutive days without rain; (2) partial drought, being a period of 28 or more consecutive days in which the total rainfall did not exceed 0·25 inch. But engineers speak of droughts varying from 140 even to 240 days; these can bear no comparison with the above definitions, and Mr. Symons suggests a third term, viz. long drought, being a period of not less than 60 days with a total rainfall of not less than 2 inches. Opinions are wanted as to how the records of rainfall observers may be best utilized in the form most useful to engineers.

MR. J. W. OLIVER has contributed an article to *Longman's Magazine* for October on the moon and the weather, in which he discusses some of the most important of the popular predictions in which the moon is concerned. He deals (1) with the lunar notions that are utterly absurd, and (2) with those that are explicable by the aid of physical principles. The conclusion at which he arrives is that there is more nonsense than sense in lunar predictions, but that it is unfair to consider the whole subject as unworthy of serious treatment. For instance, atmospheric tides due to the moon's attraction must exist, although generally obliterated by disturbances due to other causes. The author apparently favours Sir John Herschel's statement of the tendency of the full moon to clear the sky, and in support of that theory he quotes the experiments of Melloni and others, showing that moonlight contains a minute proportion of dark heat rays, the effect of which may in a certain measure cause the dispersion of the clouds. The lunar halo is also referred to as an old sign of bad weather. Of 61 halos observed near London 34 were followed by rain within 24 hours and 19 within four days. In the *Mittheilungen aus dem Gebiete des Seewesens* for June, published by the Hydrographic Office of Pola, Capt. C. von Bermann has an article upon the same subject. He deals chiefly with Herr Falb's attempt to reinstate the moon's influence in his work "Das Wetter und der Mond." The result arrived at is that, although the moon has an influence on the weather, it is too infinitesimal, compared with other influences, to be appreciable.

THE Annual Report of the Meteorological Observer for Tasmania for the year 1886 gives the results of observations taken at 11 stations and rainfall reports from 37 stations.

THE SIXTH INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY IN VIENNA.

(FROM OUR OWN CORRESPONDENT).

THE most important questions dealt with at the Vienna Congress were those relating to preventive medicine, a branch of medical science which originated with Edward Jenner's discovery of immunity from small-pox by means of vaccination. The high value of vaccination and re-vaccination was clearly shown in the Demographic Section of the Congress by statistical tables exhibited by T. Körösi, the Director of the Statistical Office in Buda-Pesth. According to these tables the mortality of the not-vaccinated patients treated in nineteen Hungarian small-pox hospitals was 800 per cent. larger than that of the vaccinated patients, while the receptivity for getting the disease was three and a half times larger in the not-vaccinated as compared with the vaccinated people. In the Fourth Section the question of vaccination was also submitted for discussion by a lecture delivered by a Turkish delegate, Dr. Violi, and a resolution recommending to all Governments the introduction of compulsory vaccination was unanimously adopted.

Thanks to the valuable discoveries of Pasteur, the method of protecting the life and health of men as well as animals by vaccination has been worked out more extensively, and is now applied with the best success against various desolating and destructive diseases. The beneficial effects of the various methods of preventive inoculations, the amount of saving of human and animal life brought about by their use, will easily be perceived by a sketch of the discussions which were held at the last meetings of the Third Section of the Congress.

A special sub-section was formed where the special results obtained by the preventive inoculations in splenic fever, and erysipelas of the pig, were reported and discussed upon. Dr. Lydtin, of Carlsruhe, gave an interesting account of the development of the measures against the different plagues, alluding also to the defects of repressive measures, by which cattle-trade and cattle-breeding are so severely affected. While two centuries ago the first trials made of providing immunity against sheep-pox and other plagues were based on purely empirical views, the recent bacteriological discoveries have led to the scientific method of vaccination with an attenuated virus. Dr. Chamberland, Pasteur's assistant, reported on the results obtained by the preventive inoculations against (charbon) splenic fever in France, Hungary, Italy, and Russia. In the year 1886, 367,208 of sheep and 47,229 of cattle had been subjected to anti-charbon inoculations. Chamberland's statements were considerably supported by the results obtained with Pasteur's methods in Switzerland and at Pakisch, Prussia, which were communicated by Dr. Custer of Zurich and Dr. Lydtin (Carlsruhe). On the other side, the practical value of the preventive inoculations in splenic fever was severely contested by Dr. Löffler, of the Berlin School. An animated discussion on this subject went on for three hours and a half.

By the majority of the speakers it was pointed out that no loss by death—or only a small percentage of such loss—was caused by the inoculation itself in cattle, and that the number of cases of natural splenic fever decreased very much after the preventive inoculations; but in sheep the vaccinations against charbon were not equally favourable. As to the duration of the immunity acquired by the vaccination no positive statements could be made.

Then the usefulness of preventive inoculations against charbon symptomatique (Rauschbrand) was dealt with, and was acknowledged by all the speakers. In the course of the discussion on the preventive inoculations against erysipelas in the pig—a discussion in which Drs. Lydtin, Chamberland, and Prof. Czokor of Vienna, took part—it was stated that by the inoculations the animals get immunity against the disease, but that further improvements of the method are wanted, as there is now a considerable loss of inoculated animals by the vaccination itself, and sometimes the spreading of disease in healthy animals. In conclusion it was resolved on a vote that the experiments on preventive inoculations against splenic fever, charbon symptomatique, "erysipelas of the pig," and the other epizootics ought to be continued under the control of and assisted by Governments.

The battle-ground of the Congress from a scientific point of view was the discussion on the preventive inoculations against rabies. Dr. Chamberland gave a *résumé* of the development of Pasteur's method, and the results obtained by this treatment in France. 2682 persons were treated and the average mortality was only 7·5 per cent.; while the mortality of persons bitten by rabid animals if not inoculated varied between 5 and 30 per cent., according to the statements made by different authors. In answering the objections made by some recent writers who had expressed the opinion that the death of patients from hydrophobia was caused by the inoculations themselves, he maintained that it was proved by experiments made with the spinal cord of those persons that the death was caused by the bite of the rabid animal, not by the inoculations. If animals were inoculated with brain emulsions of those persons they became rabid, but they died on the fourteenth or fifteenth day after inoculation, while they would have succumbed on the seventh day if the death of the persons had been caused by the inoculated virus.

Dr. Bordoni-Uffreduzzi of Turin, in making experiments on dogs and animals, found that various parts of the brain of rabid animals show different degrees of virulence. The pancreatic gland is nearly as virulent as the brain, while the liver and spleen seem to act much less strongly as media of the virus. He had also treated 119 persons bitten by rabid dogs; three of them died.

Dr. Emmerich Ullmann, assistant of Prof. Albert of Vienna, has performed preventive inoculations in 122 persons. Only persons who could prove by documents the rabid condition of

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the biting animal were submitted to the treatment, and only the weak inoculations were used. The rabid condition of the biting animal was in all the cases proved either by experiments with the brain of the animals or by *post-mortem* examinations. Out of the 122 patients treated, whose ages varied between fourteen months and sixty-one years, three died; the rate of mortality being 2·4 per cent. In fourteen cases the wounds were on the head or in the face. To this series belonged two deaths; while in seventy-two cases the upper extremity was the seat of the wound, in which group the third death occurred. As Pasteur had laid great stress on the previous cauterization of the wounds, Dr. Ullmann was carrying out some experiments to examine the influence of cauterization. Animals were infected subcutaneously with the virus of rabies, and then treated with cauterizations by lapis infernalis or fuming nitric acid. All these animals died from rabies, even when the cauterization was applied immediately after the infection, as could be shown by experimental inoculation with their brains. Only two animals cauterized on the spot with the Paqueline (ferrum candens) remained healthy. The eminent value of the preventive inoculations could easily be ascertained by some of the cases treated by Dr. Ullmann. In *Rzeszow*, a Polish village, five persons were bitten by a rabid dog. Three of them were brought to Vienna, where they were treated by Pasteur's inoculations; they remained healthy, while the two others remaining at home not inoculated died from hydrophobia after two weeks. Also in some other cases, persons bitten by rabid dogs but not submitted to Pasteur's treatment died, while the inoculated persons bitten by the same animal were not attacked by the disease. These experiments seem to be crucial experiments, proving clearly the usefulness of Pasteur's method.

It may be also stated that Dr. Ullmann had to defray the expenses of his experiments and of the inoculations from his own pocket, as the Austrian Government refused to grant any subvention for carrying out Pasteur's experiments, "on account of the frequent mishaps"! It is impossible to say from what source the Government obtained knowledge of these mishaps, as it did not try to get any information on the matter either in Paris or in Vienna. On the other side, the Hungarian Government has acknowledged the high merits of M. Pasteur by conferring on him the Order of the Iron Crown.

Dr. von Frisch criticised the statistical data given by Pasteur and Chamberland. He argued that there should be a decrease of cases of rabies if the method were successful; but the number of cases has increased. The fixed virus is an inconstant power, the period of incubation after its inoculation being a various one, not restricted to seven or eight days. Inoculation after previous infection does not provide certain immunity. The compulsory inoculation of dogs should be introduced to prevent rabies in man.

Prof. Metschnikoff, the celebrated Russian biologist, reported on the results obtained at the Bacteriological Station of Odessa. 713 persons, bitten by rabid animals, had been treated by Dr. Gamaleia. At first the results obtained were unfavourable, too weak emulsions having been used for the inoculations, as was proved by later experiments. Since July 1886, 532 persons were treated by the intensive method. In 137 out of these 532 cases, emulsions weaker than of two-days' incubations were injected; 9 persons died, the rate of mortality being 6·5 per cent. Of 88 persons inoculated once with a two-days' virus, 2 died (*i.e.* 2·3 per cent.); while among the last 307 cases, treated at least twice with a two-days' emulsion, only 2 deaths (0·6 per cent.) occurred. The average mortality in all these 532 cases was 2·4 per cent. The value of the intensive treatment could easily be understood in the case of persons bitten by rabid wolves. Of 36 persons bitten by rabid wolves, 6 were subjected to the weak treatment, and 2 of them died; the other 30, inoculated with two-days' virus, remaining healthy. In some cases even the one-day's virus was used with the best results; *e.g.* among 5 persons bitten by rabid wolves, inoculated six times with one-day's virus, the outbreak of rabies had been prevented. Experiments on 1500 animals were carried out by Dr. Bardach, who was able to prove the correctness of Pasteur's statements regarding the seven-days' period of incubation of his fixed virus. In some cases, however, the period of incubation was found to be prolonged; but the prolongation was caused by some other parasitic diseases of the animals, which will be described by Dr. Bardach in a forthcoming paper. In concluding his report, Prof. Metschnikoff stated that "the results obtained at the Odessa Bacteriological Station are very strongly in favour of Pasteur's discoveries, which decidedly must be regarded as epoch-making."

Dr. De Renzi (Naples), described his experiments on rabbits, in which, by the injecting of brain-emulsion into the blood-vessels, rabies had been produced. But neither by this method nor by subcutaneous injections of the fixed virus was he in every case able to produce rabies in rabbits, which sometimes showed immunity against this infection. He expressed also the opinion that no gradual difference of the attenuation of the virus seems to exist.

In summing up the different views of the speakers Dr. Chamberland was able to state that the high value of Pasteur's discoveries was acknowledged by everybody.

THE MINERAL WEALTH OF THE UNITED STATES.

On Saturday, October 8, a lecture on this subject was delivered at the American Exhibition by Dr. A. E. Foote, of Philadelphia, who, as Acting Commissioner from Pennsylvania, has exhibited a fine collection illustrating the mineral resources of that great State. The Chairman, Mr. F. W. Rudler, President of the Geologists' Association, congratulated the audience upon being able to listen to one who, from his very extensive and personal observation, was well qualified to treat such a subject.

Dr. Foote pointed out that the geological formation of a country was the basis of its mineral wealth, and illustrated this by the remarkably fine large geological map of the United States compiled by Prof. Hitchcock from the work done by the United States and State Geological Surveys. His statistics were mostly based upon Williams's "Mineral Resources," of 1885.

As a Pennsylvanian he was happy to say that of 95,000,000 of tons of coal mined in that year nearly two-thirds the tonnage, and fully two-thirds the value, was produced in Pennsylvania. Of this amount 34,000,000 of tons was anthracite. The Girard Trust, that noblest of America's educational charities, exhibits a mass of anthracite from their mines in Schuylkill County, Pennsylvania, that measures 22½ cubic feet, and weighs 2256 pounds. Coal is now found in workable quantities in thirty States and Territories. Of iron there was less in value mined in 1884 than the value of the petroleum—£4,000,000 sterling—but with the steady revival of business the production has rapidly increased, until this year it may reach a total of £6,000,000 sterling. The iron area is being developed almost as rapidly as the coal. The greatest activity has been manifested in Alabama, near Sheffield and Birmingham. The latter city is the most wonderful example of rapid, solid business development that America has ever seen. Perhaps nowhere else in the world can such a favourable combination of coal, iron, and limestone be found.

But for the remarkable development of natural gas near Pittsburg, far more of Pennsylvania's capital would have been transferred to this favoured locality. Natural gas was first used for lighting the town of Fredonia, New York, in 1825, and this well, still in operation, was pronounced by Humboldt an eighth wonder of the world. Here, however, it was used simply for lighting, but it is far better suited for heating, owing to the absence of the heavy hydro-carbons. It is principally marsh-gas, ethane, hydrogen, and nitrogen. In October of 1875 it was first used in the smelting of iron at the mills of Spang, Chalfant, and Co., at Etna, near Pittsburg. The gas was brought 17 miles from the "Harvey," the leading well of the region. When turned into the 6-inch iron pipe the pressure was so great that it travelled the entire distance in twenty-two minutes. Mr. Foote visited the works in December 1875, and it was already in full and successful operation, turning out the purest iron, equal to the best Swedish. Its success was so striking that it was almost instantly introduced into all the iron, glass, and other manufactories of this great centre of America's industry. It is also used in all the heating and lighting of the city. The cost is about one-quarter that of coal, and it is estimated that it will this year take the place of coal to the value of £6,000,000 sterling. Not the least of its advantages is its freedom from smoke, so that what was once an unbearably dirty city now has air as pure as that of a country village. The enormous waste that has been going on is illustrated by the history of the "Haymaker" Well, No. 1, which in five years wasted £400,000 worth of gas, or nearly £200 daily. There were hundreds of such wells.

Gold and silver were touched upon very briefly, as others who were

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